Information Integration via Navy LEAPS

Enabling the 21st Century Acquisition Enterprise
3rd Simulation Based Acquisition Conference

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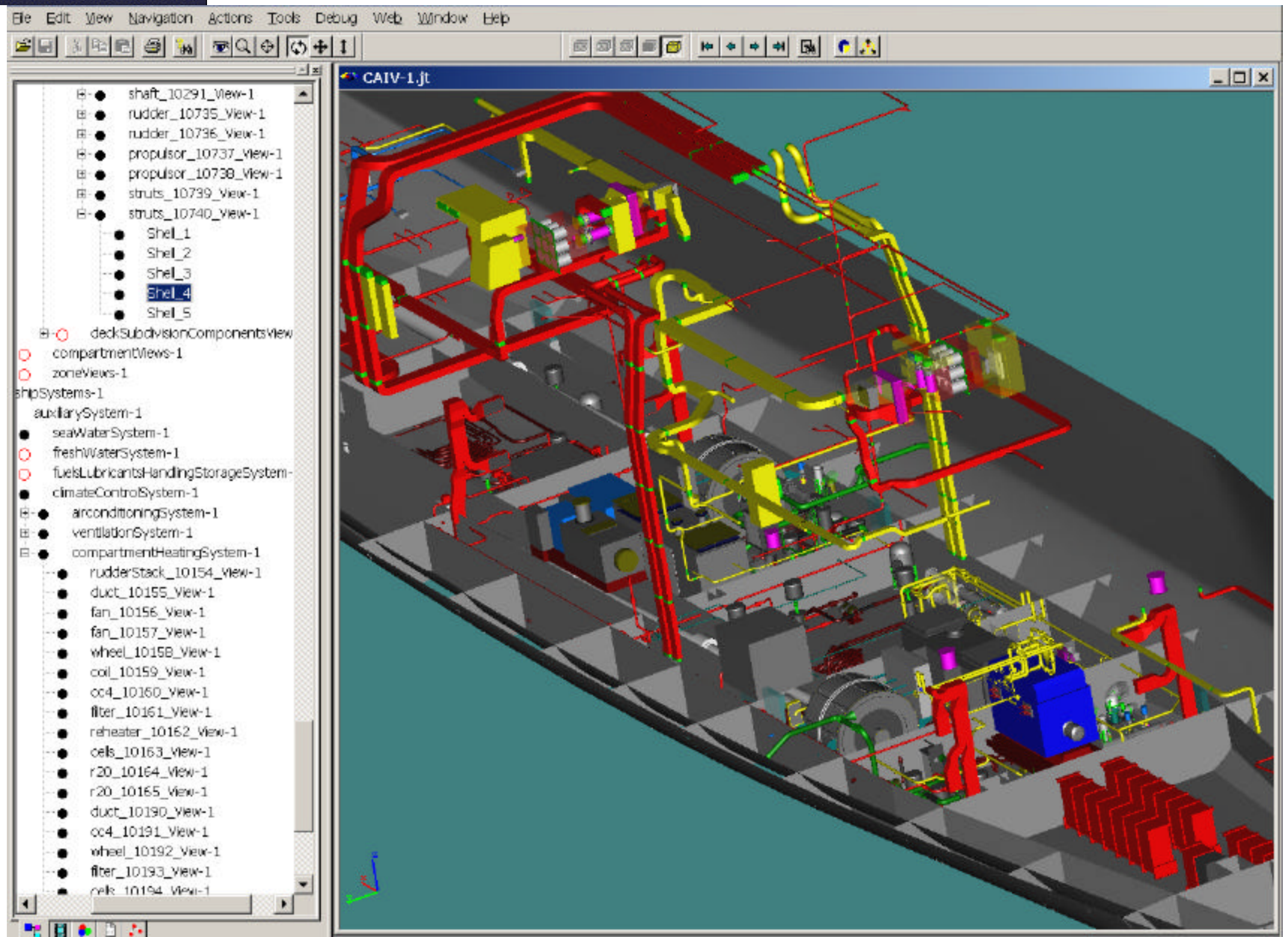
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zoneViews-1
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fuelsLubricantsHandlingStorageSystem-
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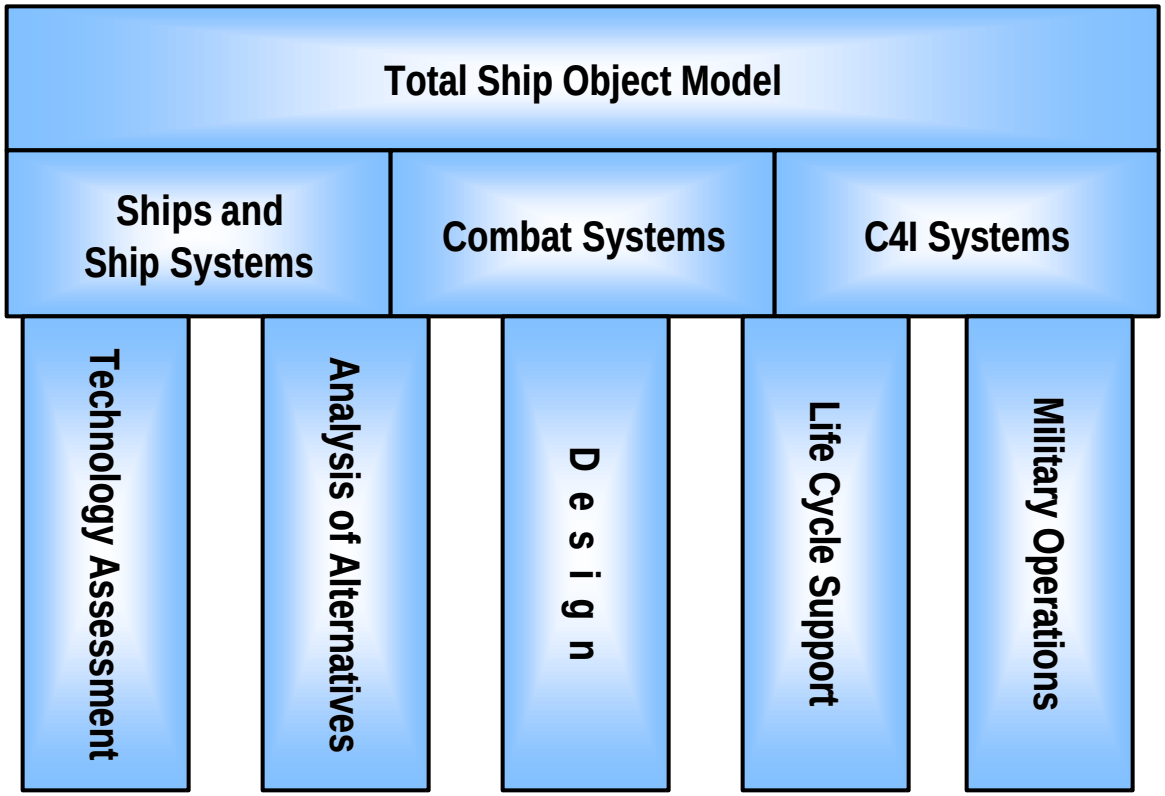
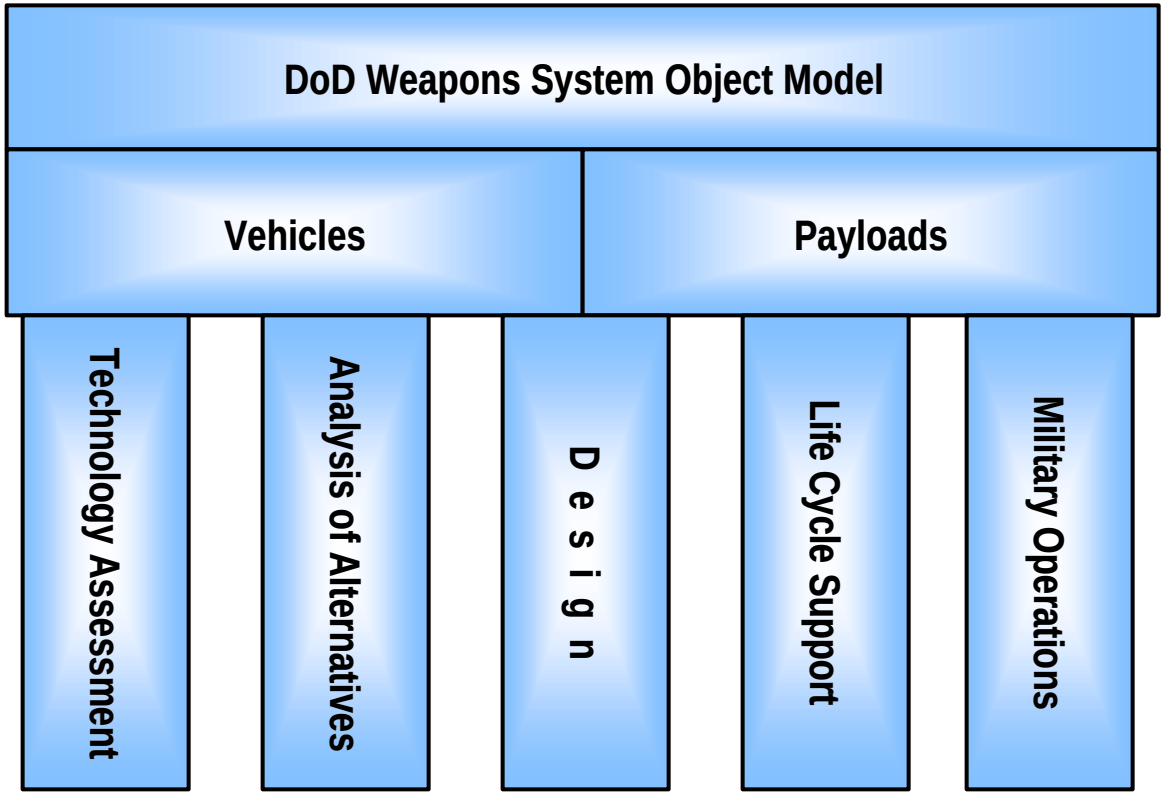
Total Ship Representation



Trade space must be expanded to include trades within and across total ship systems

DoD Weapons Systems Representation for Battle Force Integration



Trade space must be expanded to include trades within and across all systems

What is LEAPS?

- LEAPS is (pick your buzzword):
  - Smart Product Model
  - Common Integrated Data Environment
    - Component of Integrated Digital Environment
  - Integrated M&S Environment
  - Product Knowledge Management System
  - Information Facilitation System (with appropriate tools)

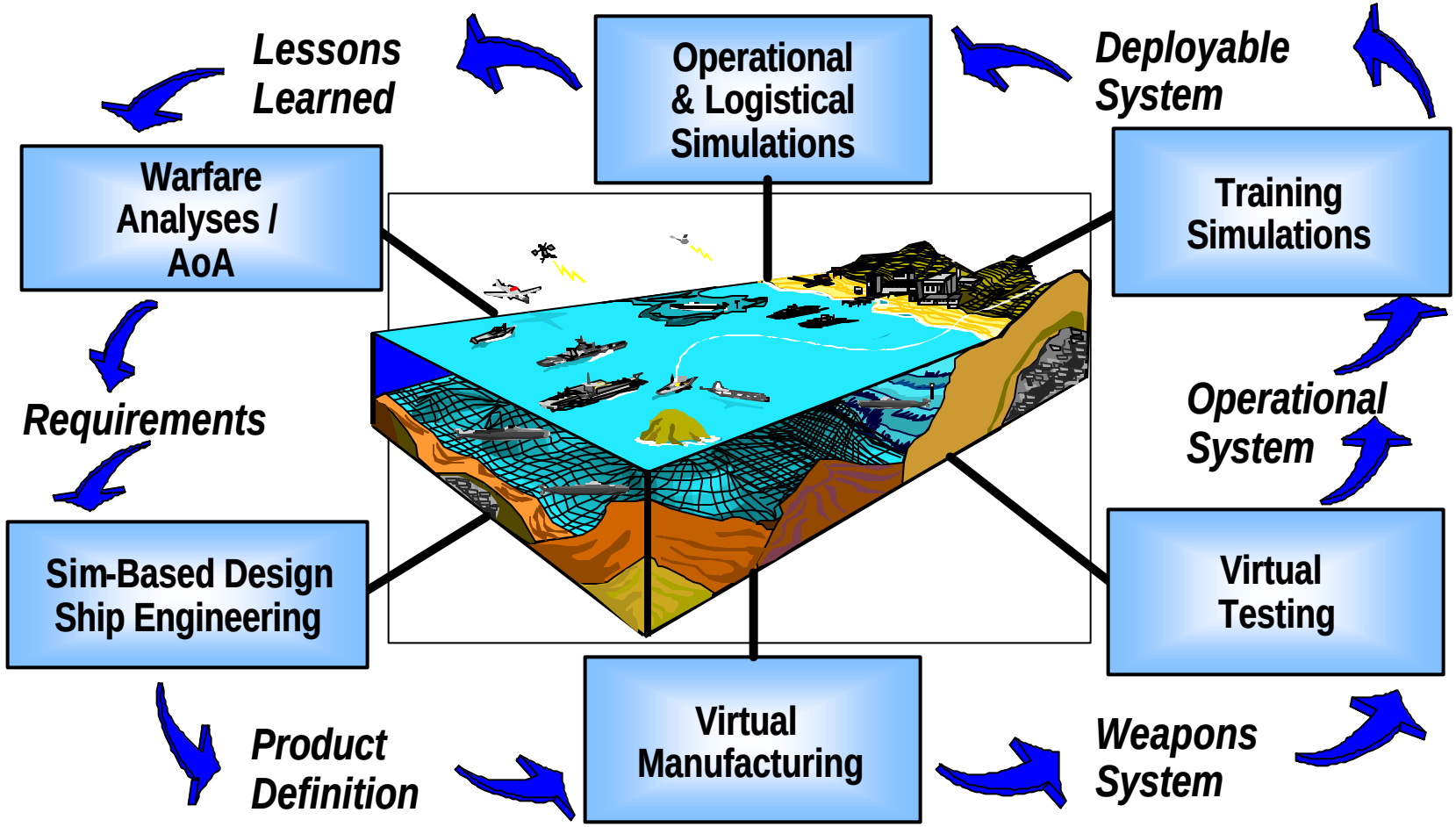
- LEAPS does **not** model, simulate, analyze, perform - people and processes do, which LEAPS facilitates

LEAPS Approach

- We're using the right approach for moving product information among applications
  - have been for 5 years
- No one else is doing it
  - across disparate applications
  - across multiple systems (Cross-PEO)

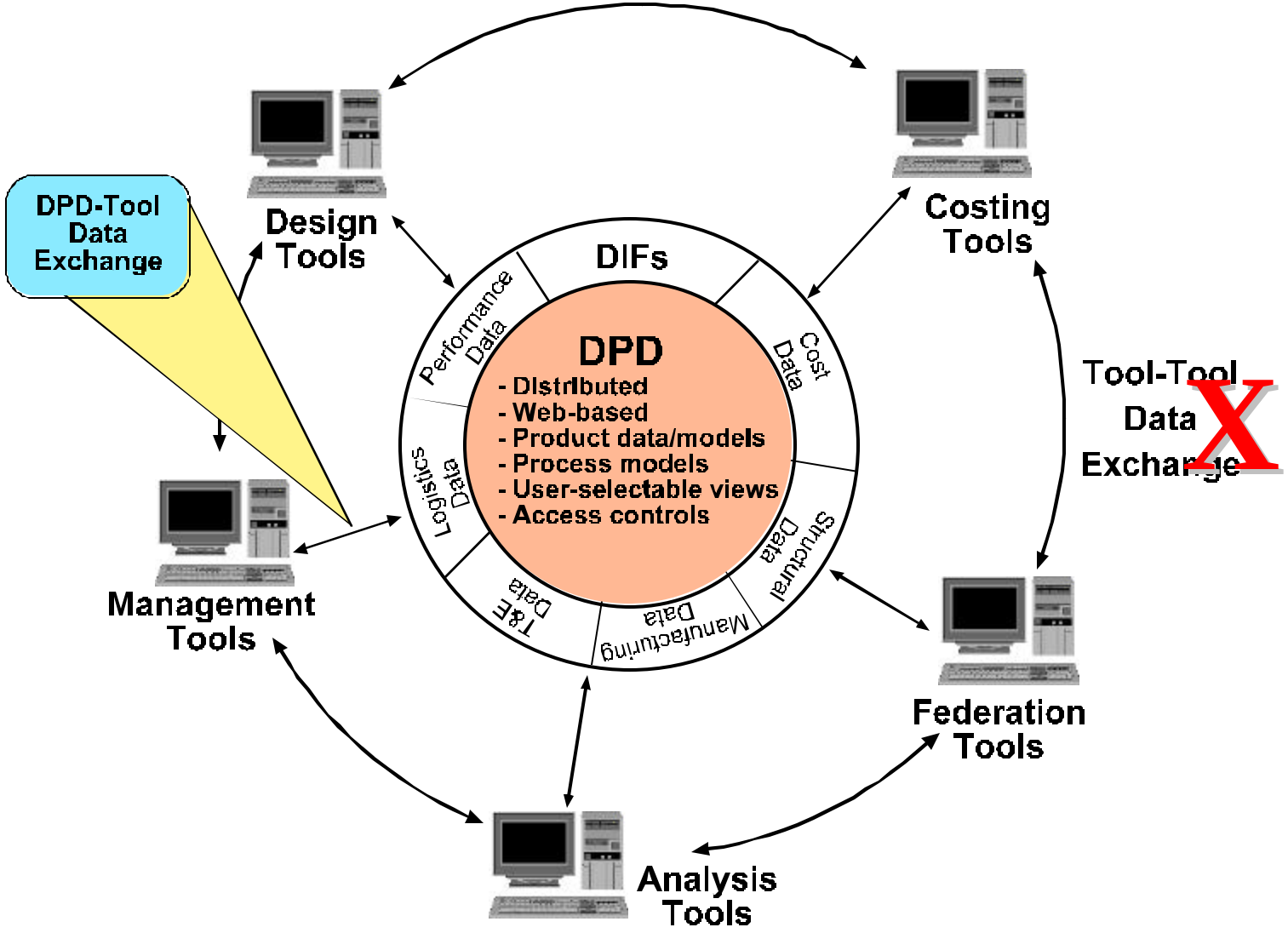
- And it implements the information underpinnings and selected applications of this:

Weapons System Virtual Life Cycle



Vision: Conceive, Design, Build, Test, Train, Operate and Interoperate a Weapons System in a Computer Before Cutting Metal; Then, use for Life Cycle Support.

Distributed Product Descriptions and Data Interchange Formats



Metrics Example

- **Data Preparation** (Extraction and Transformation)
  - IRENE (Ship Infrared Signature Prediction)
    - Pre-LEAPS: 13.5 work-days
    - LEAPS: 0.5 work-days
- **Design Review**
  - Pre-LEAPS vs. LEAPS
    - each entity knows everything about itself, and can be queried, e.g., performance, cost, requirement, relationship to any other entity, volume, weight, SWBS group, etc.

Underlying LEAPS Premises

- Navy Acquisition Programs require a common approach for accessing/exchanging data/information (Cross-DASN/Cross-PEO)
  - PEOs are in the business of weapons systems development - not information repository systems development
- You can't model what you don't know (Product Knowledge issue)
- Modeling & Simulation really can produce the advertised benefits (SBA issue)
- Modeling and Simulation methods are not used as effectively as they could/should be in acquisition programs (Timeliness/Trust issue)

Timeliness Issue

- It takes too long to:
  - Find the right information
  - Extract the information needed for a specific application domain
  - Understand the extracted information
  - Transform the extracted information to the form required for M&S software
  - Transmit the information in a form usable by the person who needs it

➢i.e., non-productive data manipulation

LEAPS Top-Level Requirement

- **Enable**
  - Timely and trusted evaluation of a design alternative for:
    - product quality
    - integration with other products

➢ Significantly **expands trade space** of design alternatives

➢ **"Timely"** requires fast information extraction/transformation:

➢ fast extraction/deposit of domain-specific information from/to a repository

➢ tools for fast input preparation for M&S software

➢ **"Trusted"** includes complete understanding of the product

Benefits

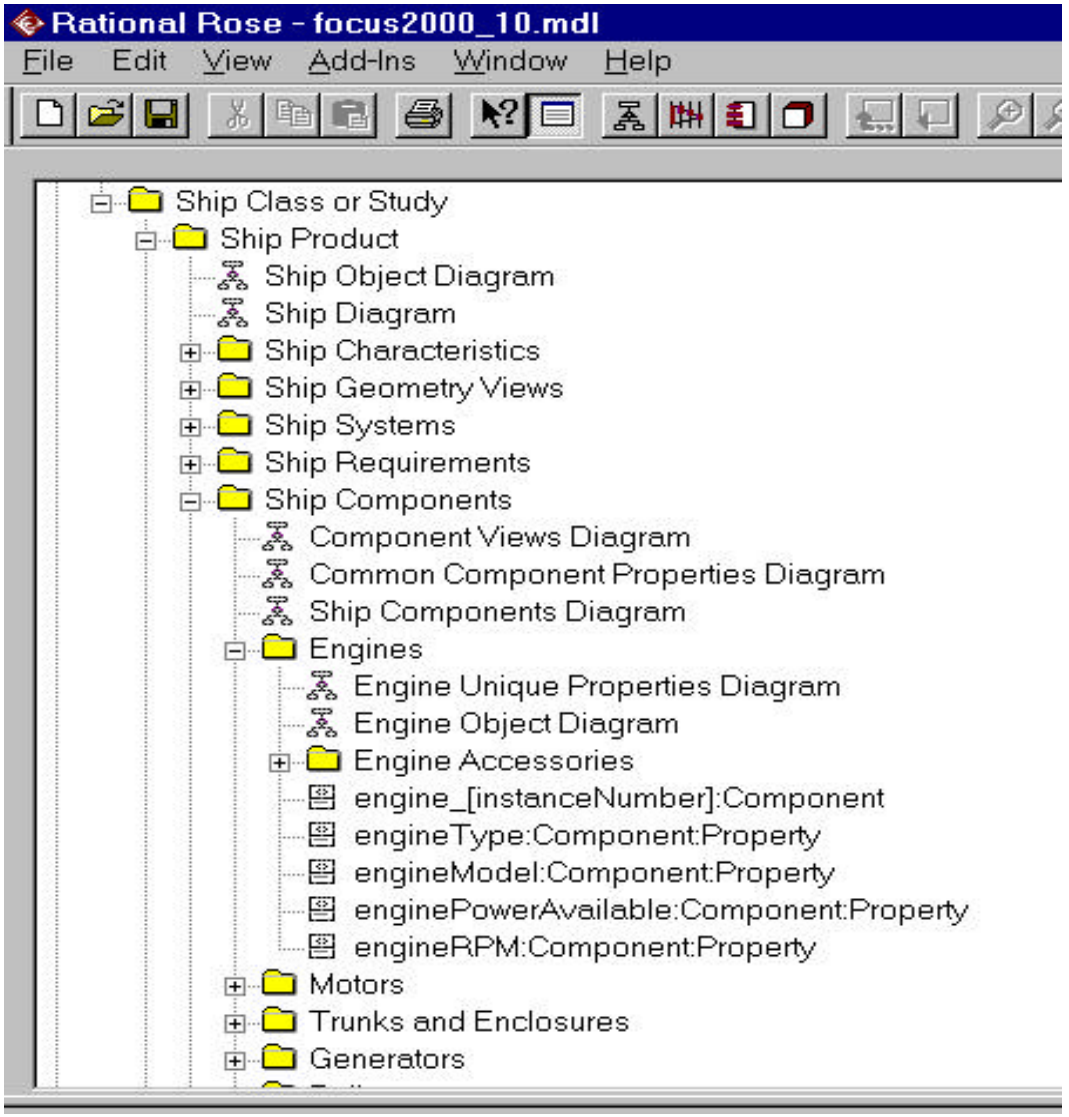
Benefits		Beneficiaries
• Cost-effective Systems	➔	• Warfighter
• Reduced Risk/Flexibility	➔	• Program Manager
• Technology Requirements	➔	• R&D Organizations
• Responsiveness to Customer	➔	• Suppliers & Customers

3-Part SBA-Based Solution

- ☆Common System Representation and Data Framework (IDE)
- ☆Integrated M&S Architecture
- ☆Generic Product Modeling Approach

Example: Ship HM&E Object Model/ Common Representation and Data Framework

- 2-D View
- 3rd Dimension is:
  - relationships
    - geometric
    - physical
    - functional
  - domain views, via data aggregation
  - rich source of context-based knowledge




RTS TESSELATOR - Microsoft Internet Explorer
RTS Tesselator
moldedRegion_0000533-1
Concept: pdc2_7-1 CommonView: rcsPerformanceDefault
Mesh Properties
Name Value New Value
OnOff: on on off
FlipNormal: no yes no
MeshDelta: 20.00 m m
Material: NONE
Part Of Common Views:
weatherExposedView-1
deckhouse_1-1
compartment_002-1
Apply New Value To:
Selected Face
Common View (Select Above)
Change Property
CLEAR
Save as CommonView:
rcsPerformanceDefault
Update Tesselation
Delete Turned Off Faces? No Yes
GET FILES: poly.dat
Faces Turned Off:
fa000000
fa000002
fa000004
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RTS Tesselator Help
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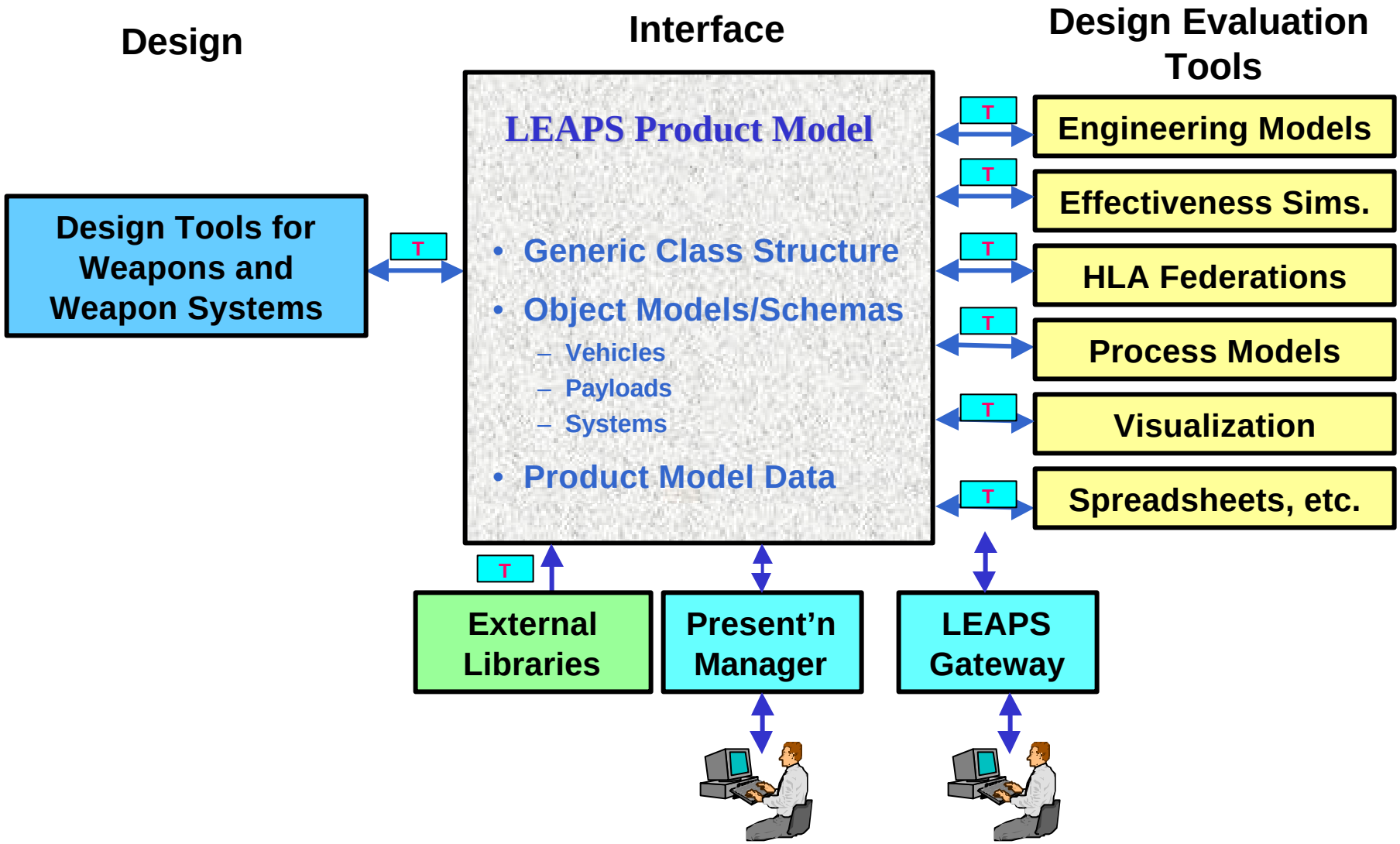
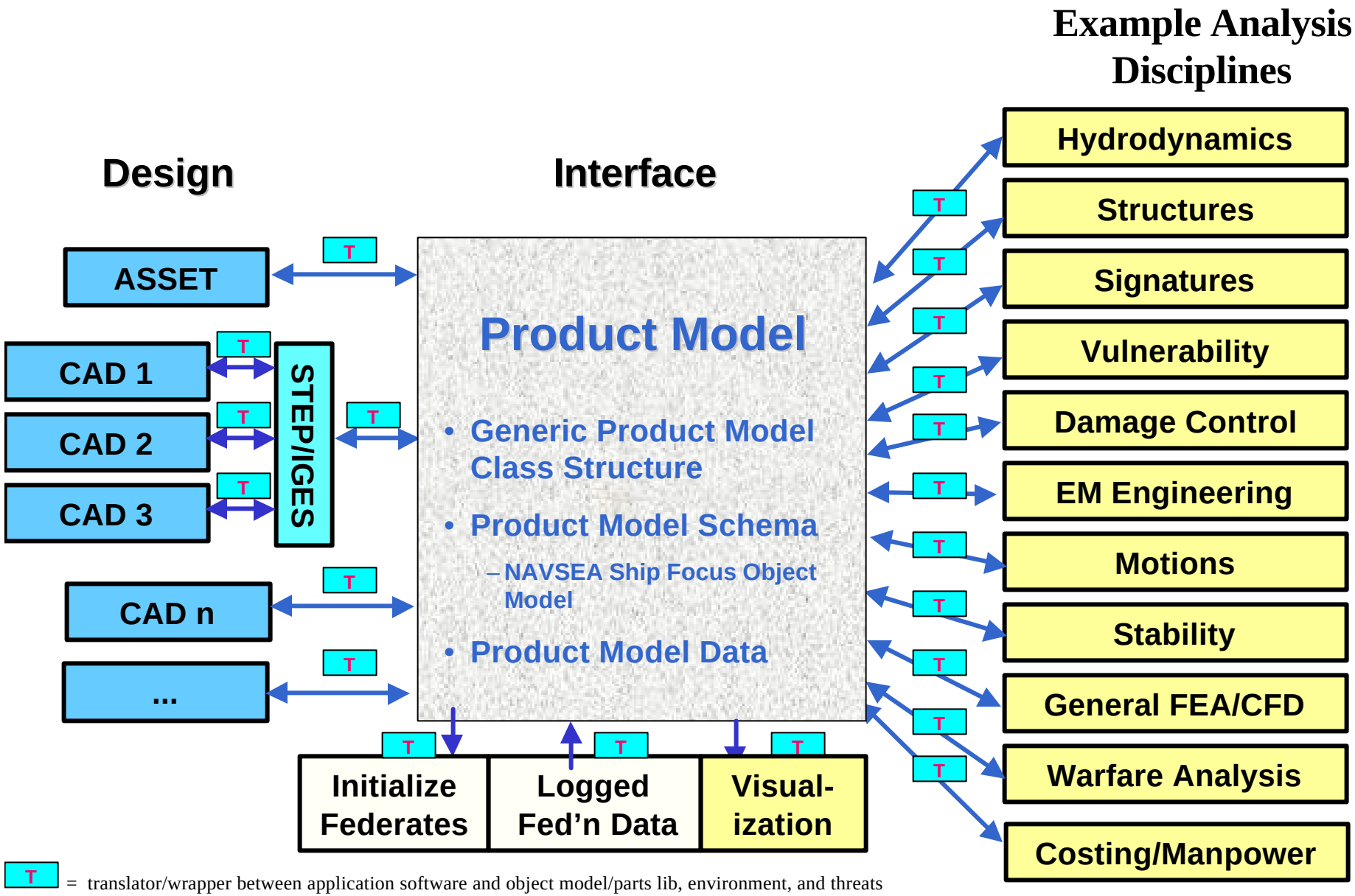
Pan
Turn
Roll
Goto
Study
Zoom Out
Straighten Up
View
Restore

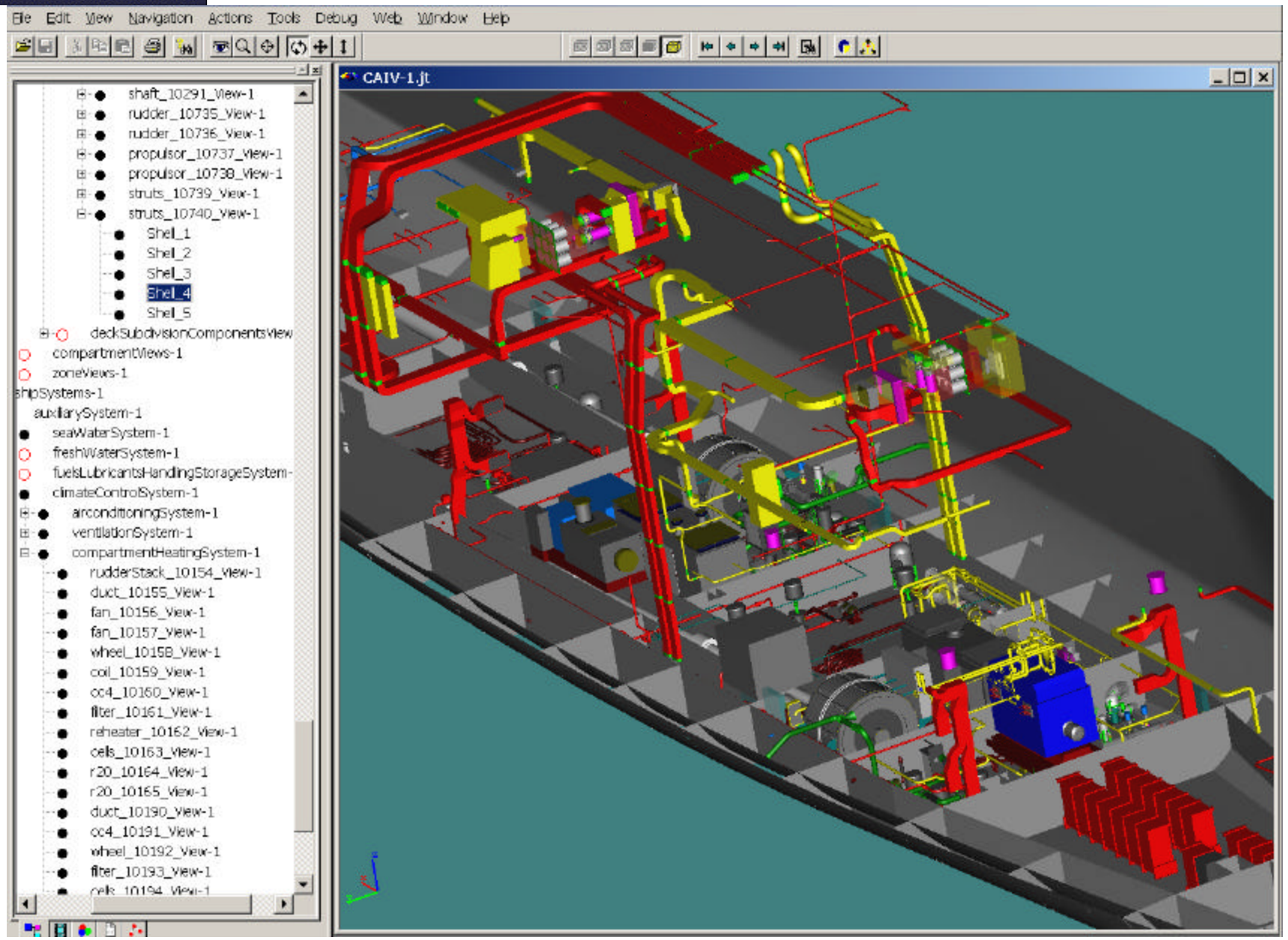
Envisioned Acquisition M&S-Based IDE Architecture



"The infrastructure for access to digital product data from the design and M&S community"

LEAPS Interoperability Concept

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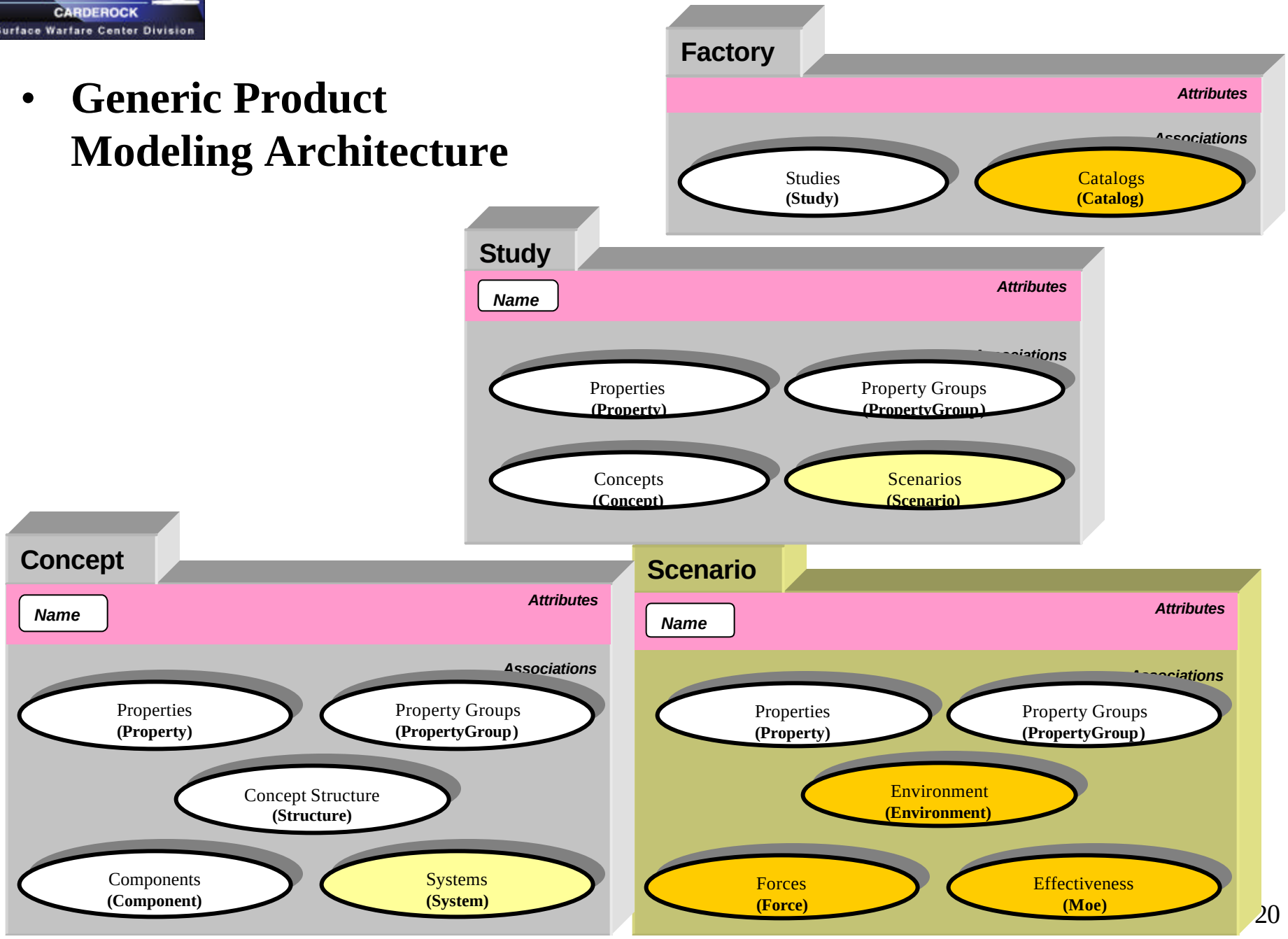
- **Generic Product Modeling Architecture**



LEAPS Team Objective for Navy Acquisition (Notional)

Generic Classes/API
Product Data Manager
Visualization
LEAPS Editor
Class Testing
Parts Library
Training/documentation

LEAPS Infrastructure

Design and Design Attribute Modeling

Ship HM&E Object Model DD,CG,CV,A,L

Submarine HM&E Object Model

Combat System Object Model

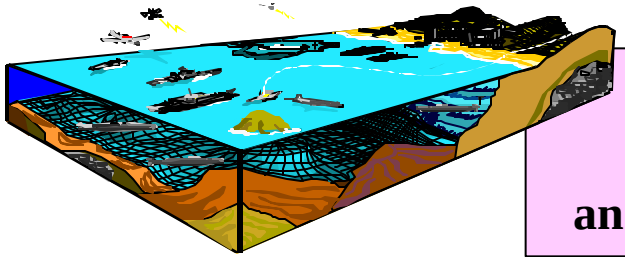
Aircraft Object Model

C4I System Object Model

Icons for Integrated M&S Architectures

Operational Effectiveness Simulations

HLA Run Time Infrastructure



LEAPS Enables HLA FOM Development via Dynamic Object and Property Creation and Using Common Taxonomy for Common Attributes

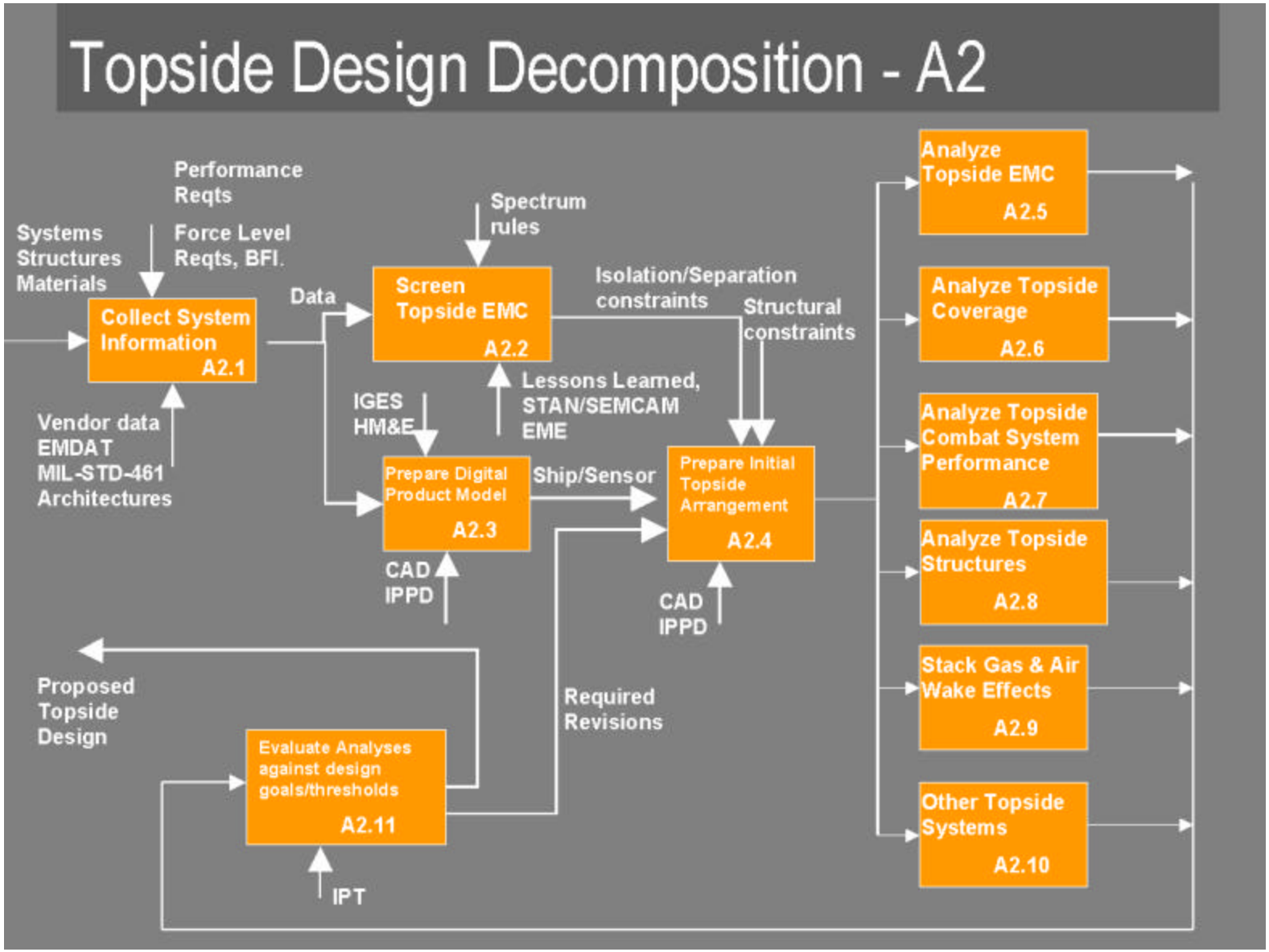
Current Participants

- **Government**
  - NSWC/Carderock
  - NSWC/Dahlgren
  - SPAWAR/SSC-SD

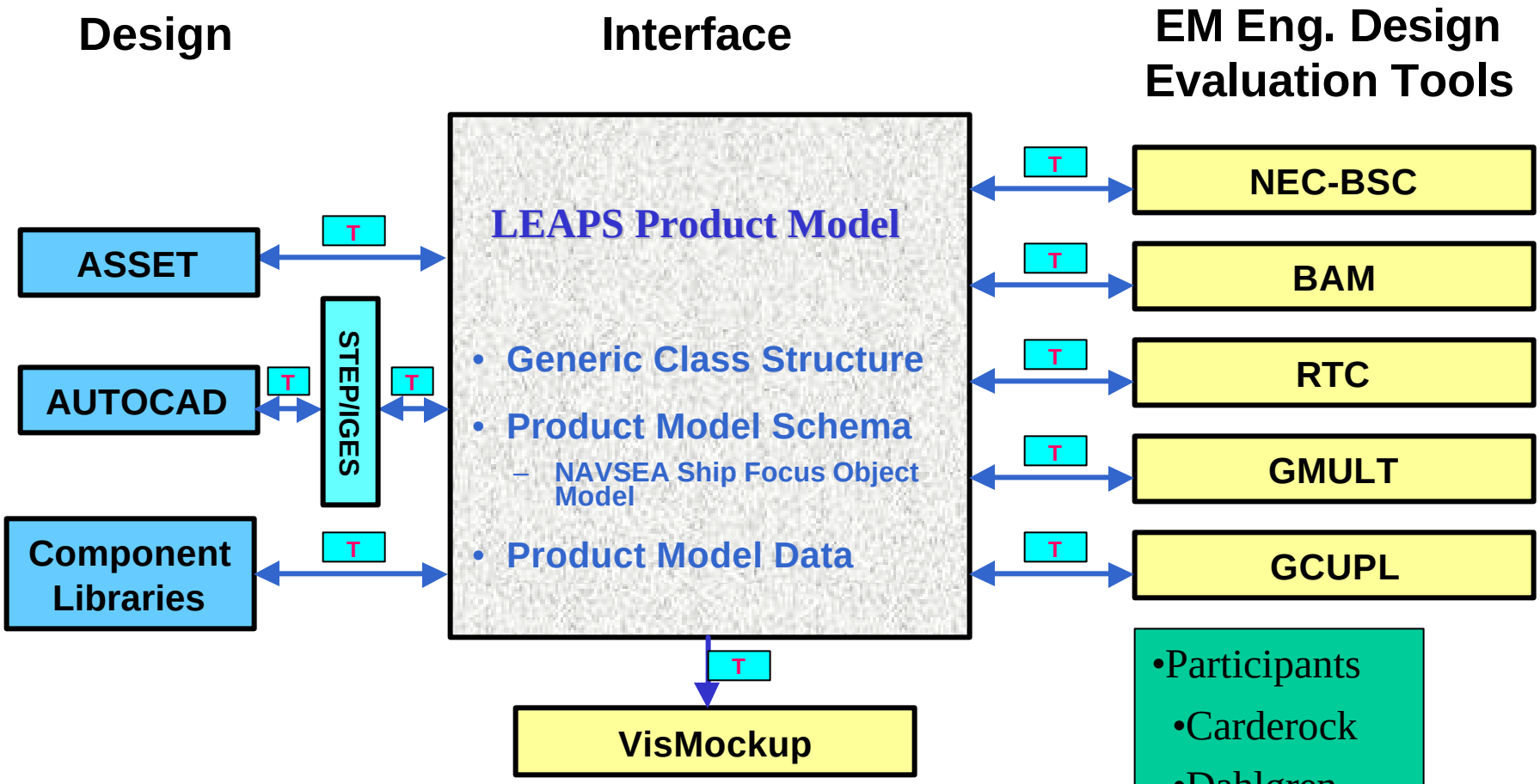
- **Industry**
  - Shipbuilder
  - Systems Integrator
  - Boeing
  - APL/JHU
  - Engineering Animation, Inc. (EAI)

Current LEAPS Program

- LHA(R) Analysis of Alternatives (AoA)
- Integrated Topside Design Capability (LHA Modernization)
- N42 Cargo Handling System
- Carderock Infrastructure Activities
  - Translators for Early Stage Design Evaluation Software
  - LEAPS API Test Suite for V&V
  - Object Model Geometry Viewer
  - Components Library
- Other - TBD
  - Joint Service Chemical-Biological Defense Program
  - NAVSEA Integrated Power System Team


Topside Design Decomposition - A2
Performance Reqts
Systems Structures Materials
Force Level Reqts, BFI.
Spectrum rules
Collect System Information A2.1
Data
Screen Topside EMC A2.2
Isolation/Separation constraints
Structural constraints
Lessons Learned, STAN/SEMCAM EME
IGES HM&E
Vendor data EMDAT MIL-STD-461 Architectures
Prepare Digital Product Model A2.3
Ship/Sensor
Prepare Initial Topside Arrangement A2.4
CAD IPPD
CAD IPPD
Analyze Topside EMC A2.5
Analyze Topside Coverage A2.6
Analyze Topside Combat System Performance A2.7
Analyze Topside Structures A2.8
Stack Gas & Air Wake Effects A2.9
Other Topside Systems A2.10
Proposed Topside Design
Required Revisions
Evaluate Analyses against design goals/thresholds A2.11
IPT

FY01 Integrated Topside Design Capability



Get the right data to the right person in the right format at the right time

T Translator/wrapper - also links to component, threat, environment, etc. libraries